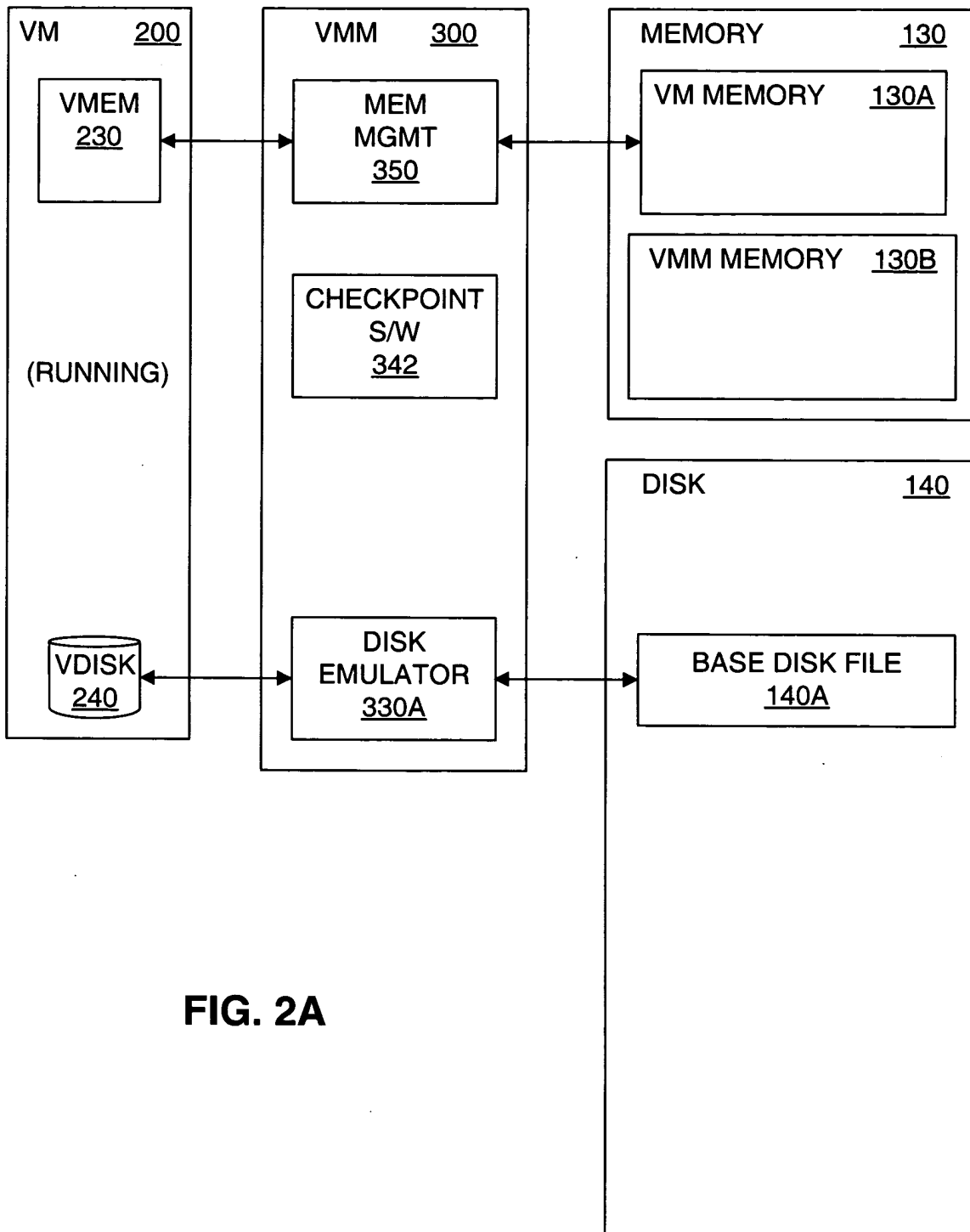
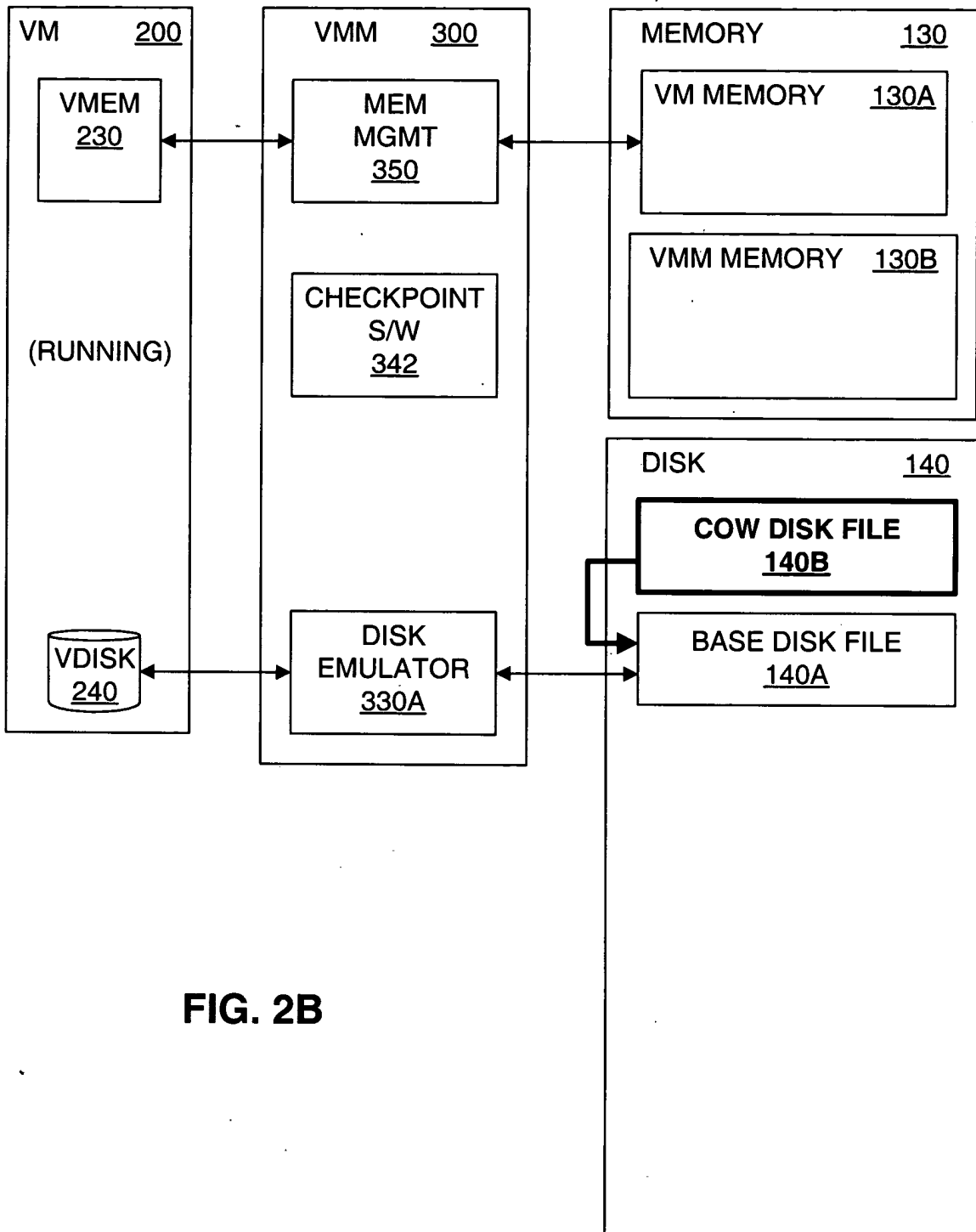


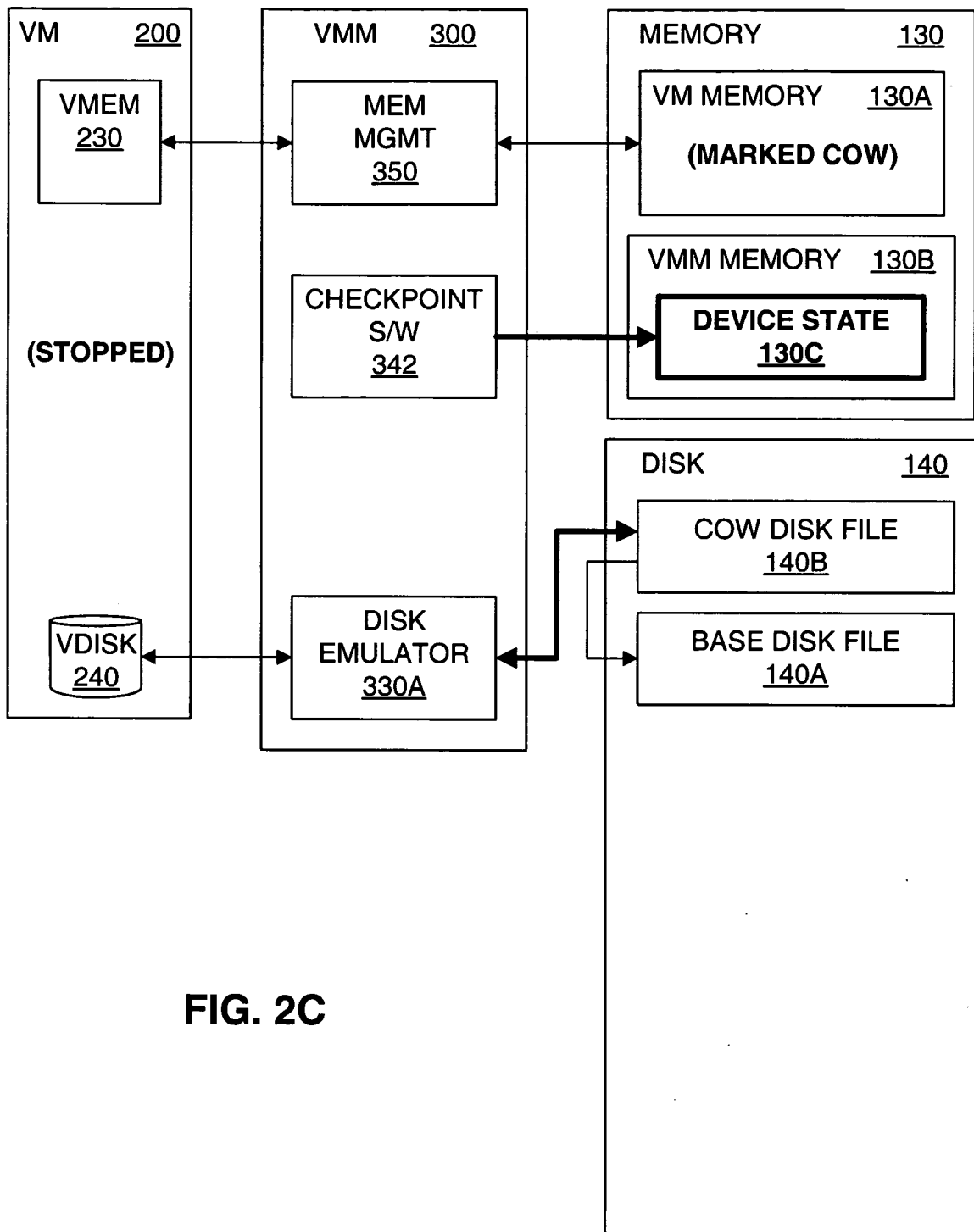
FIG. 1



**FIG. 2A**



**FIG. 2B**



**FIG. 2C**

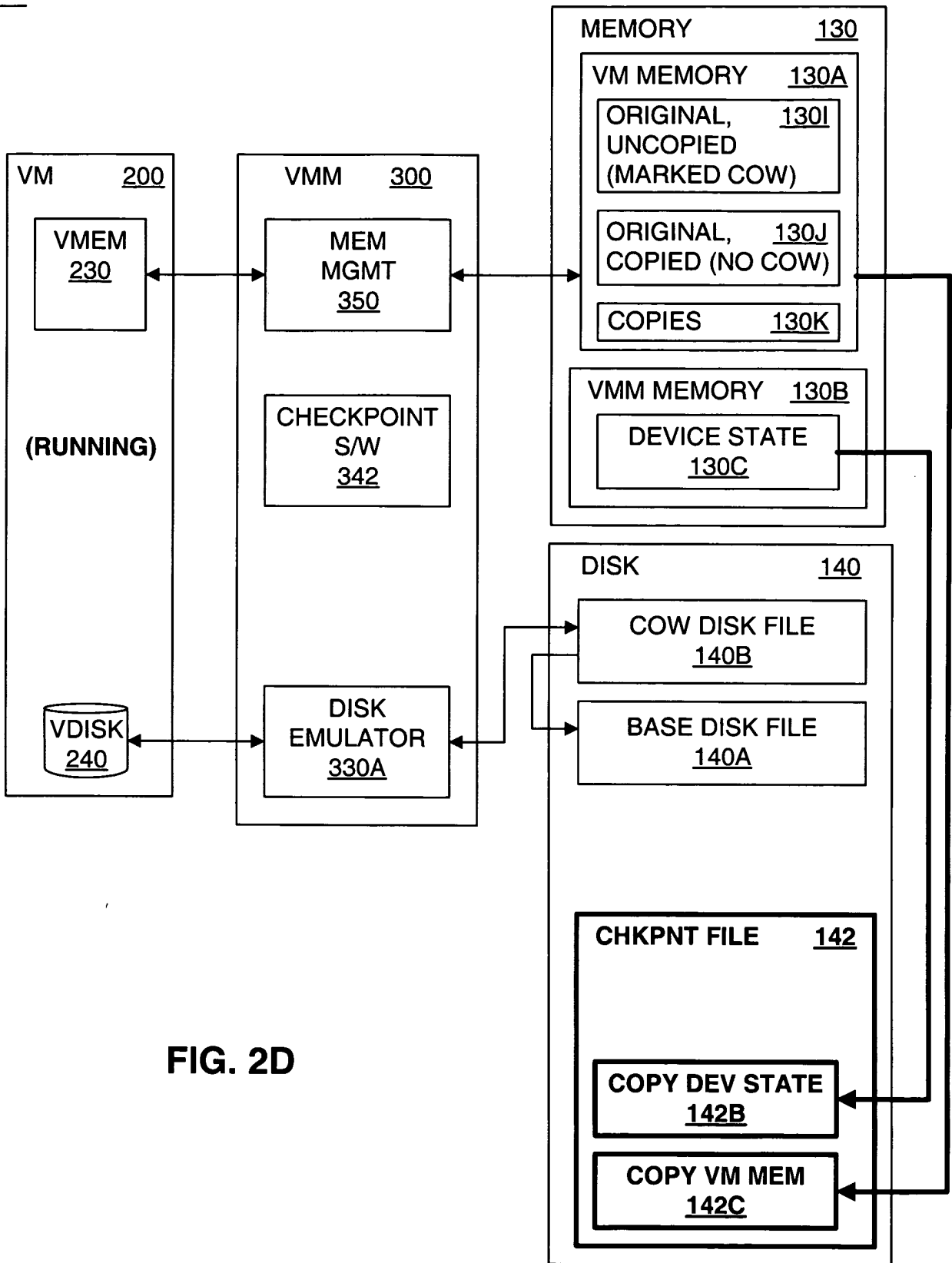


FIG. 2D

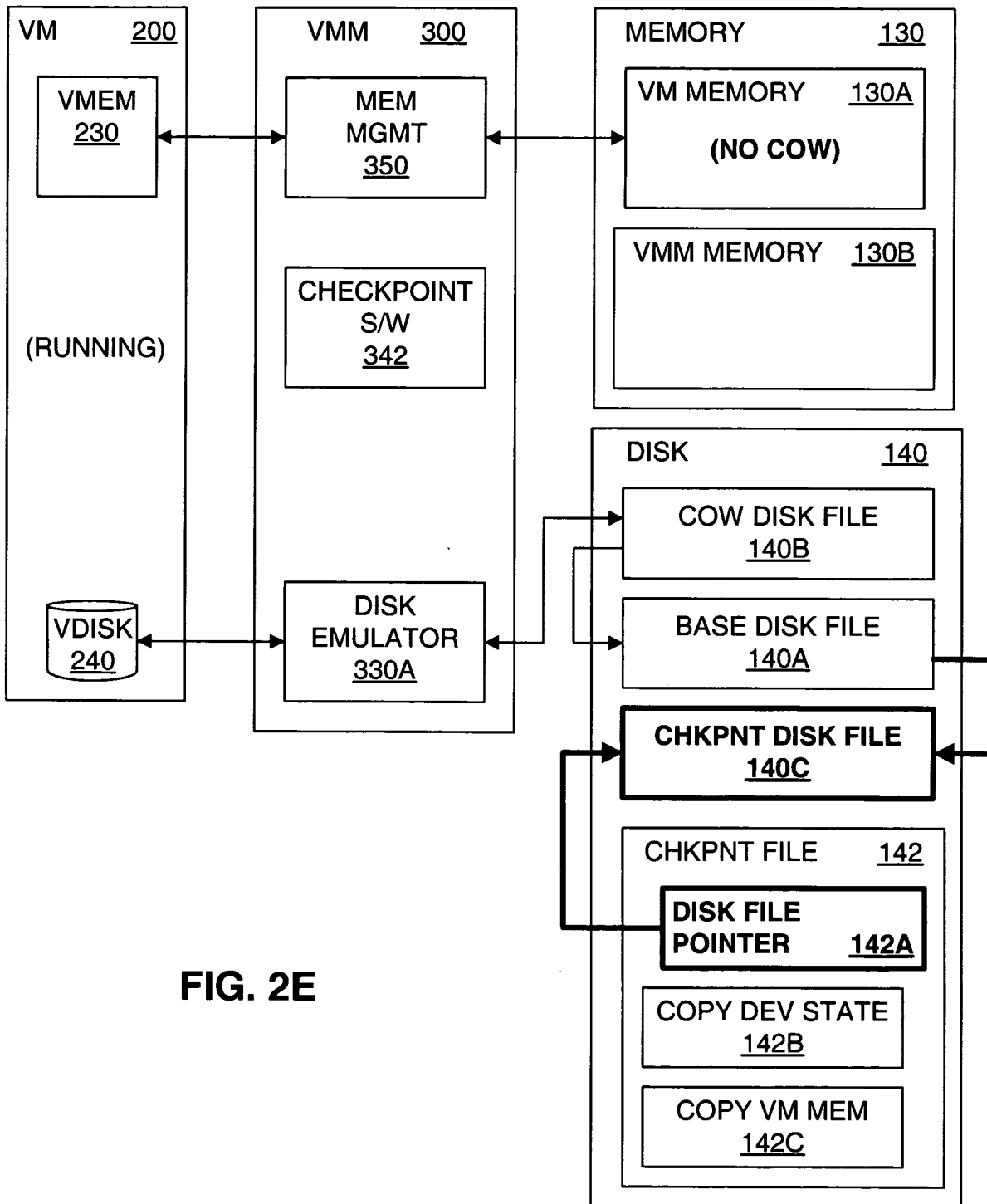
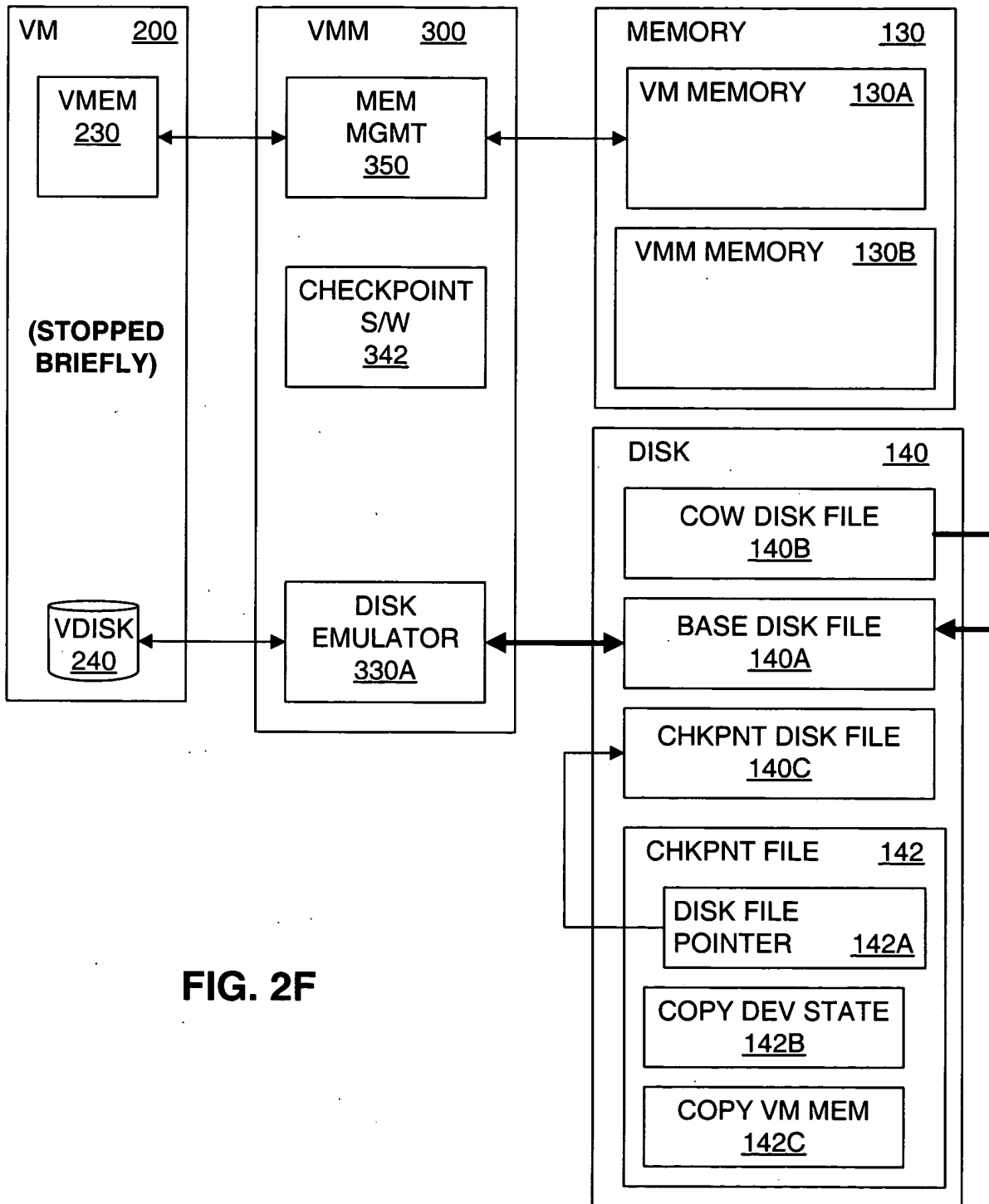
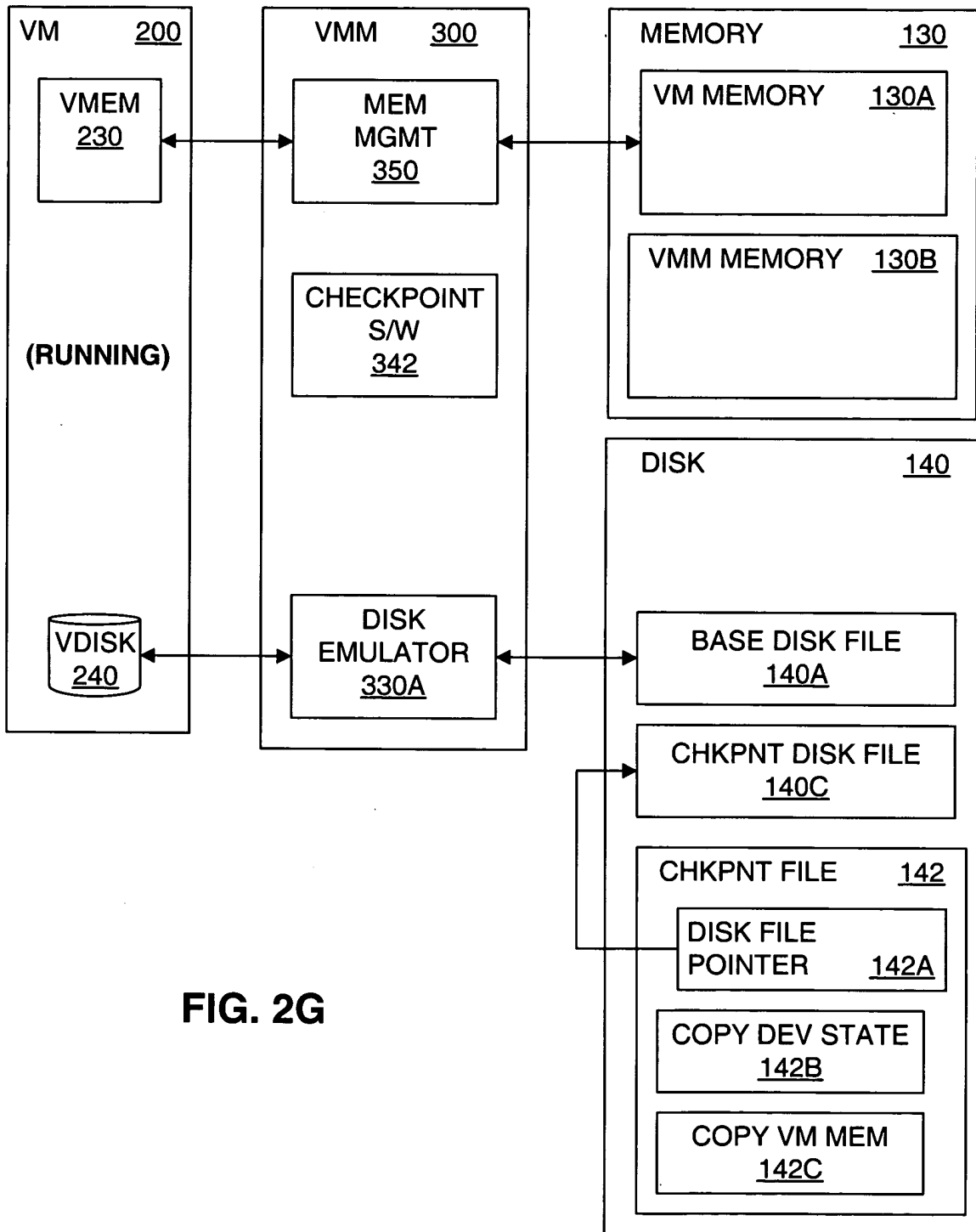


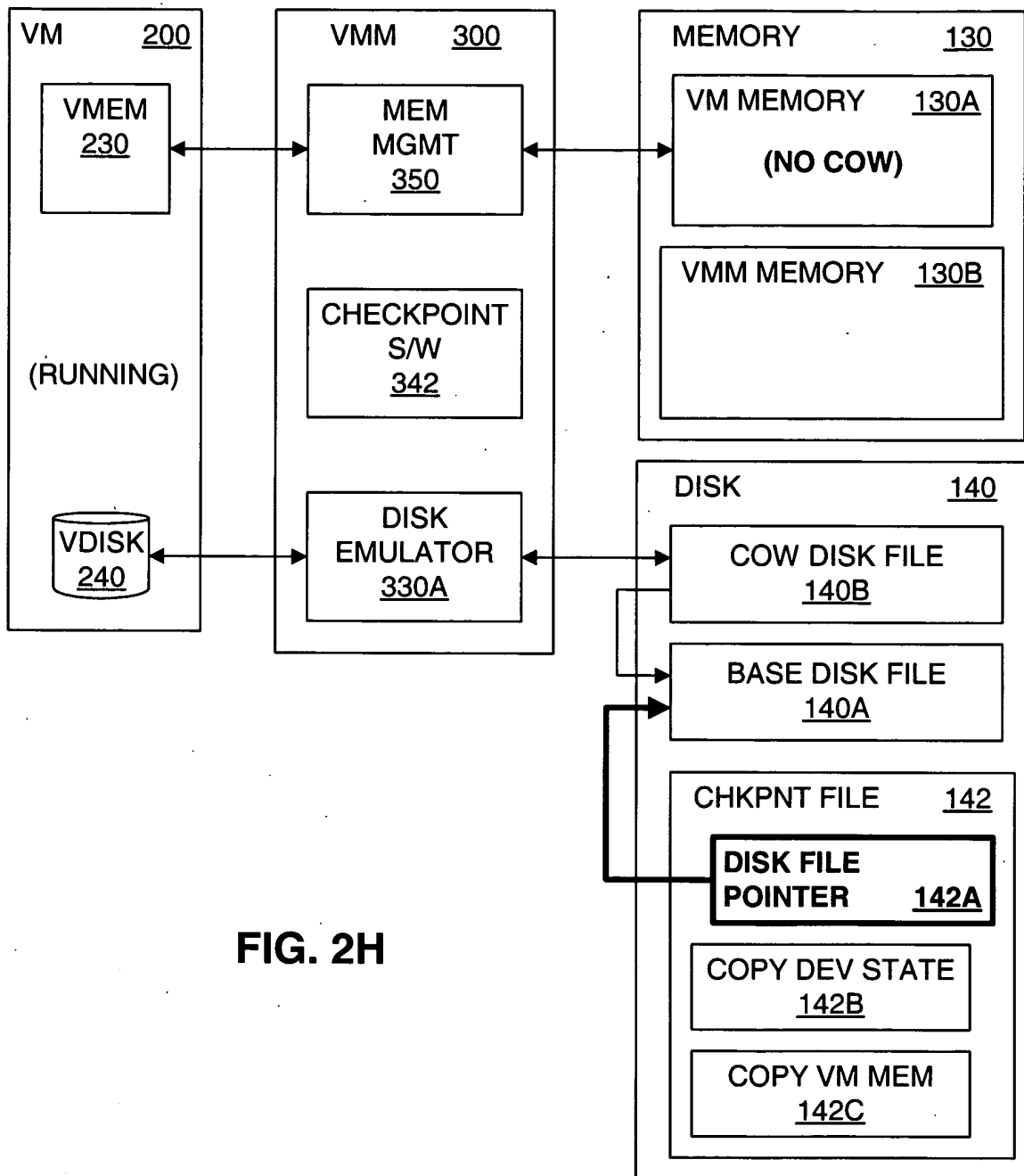
FIG. 2E



**FIG. 2F**



**FIG. 2G**



**FIG. 2H**

FIG. 2A

GEN  
CHKPNT 800

FIG. 2B

802  
CREATE NEW  
COW DISK  
FILE

FIG. 2C

804  
STOP VM

806  
MARK VM  
MEM COW

808  
SAVE DEVICE  
STATE TO  
MEM

810  
CHANGE DISK  
MAPPING TO  
NEW COW  
DISK

812  
IF PENDING RD  
THEN WR TO  
SAME BLOCK,  
THEN DELAY  
UNTIL ALL  
PENDING DISK  
OPS COMPLETE

FIG. 2D

814  
CONTINUE  
VM

815  
UNLESS DELAY  
AT STEP 812,  
REISSUE  
PENDING DISK  
READS TO COW  
FAULT PAGES

816  
FORCE COW  
MEM FAULTS  
PRIOR TO NEW  
DISK READS

818  
HANDLE COW  
FAULTS  
(FIG. 3E)

820  
SAVE DEVICE  
STATE TO  
CHKPNT FILE

822  
WAIT UNTIL  
PENDING  
DISK READS  
COMPLETE

FIG. 2E

824  
SAVE VM  
MEM TO  
CHKPNT FILE

828  
CLEAR COW  
MARKINGS

830  
COPY BASE TO  
CHKPNT DISK  
FILE, AFTER  
PENDING DISK  
WRITES  
COMPLETE

832  
ADD DISK FILE  
POINTER

FIG. 2F

834  
COMMIT  
COW DISK  
(FIG. 3F)

FIG. 2G

836  
CONTINUE  
NORMAL VM  
OPERATION

838  
END

FIG. 3A

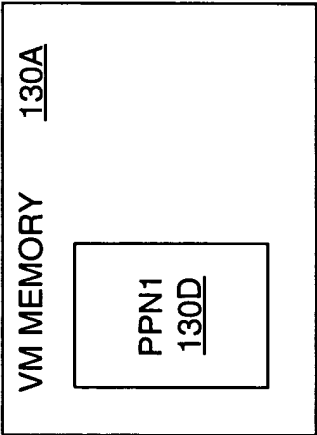
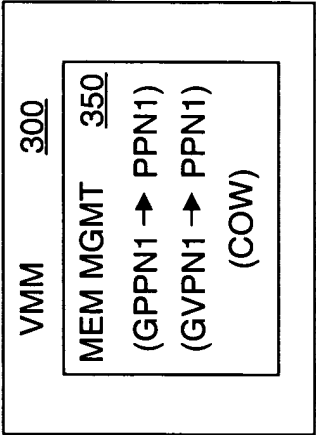
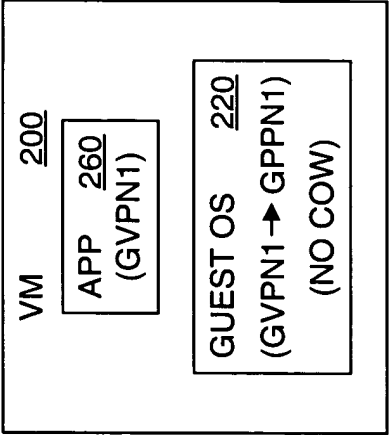


FIG. 3B

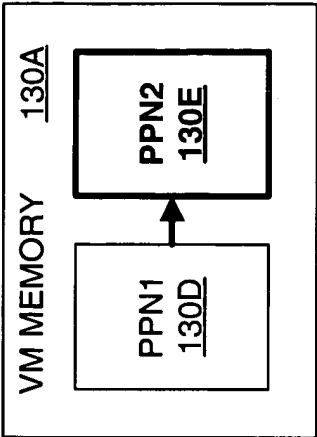
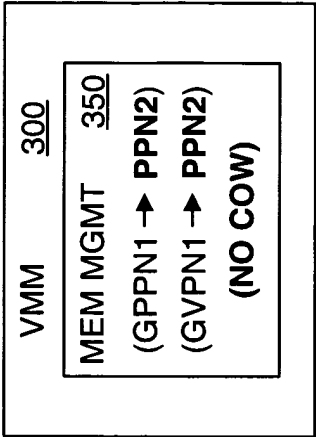
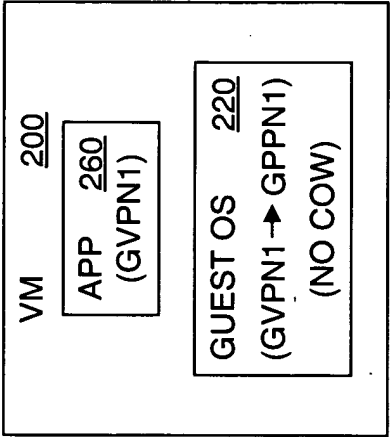
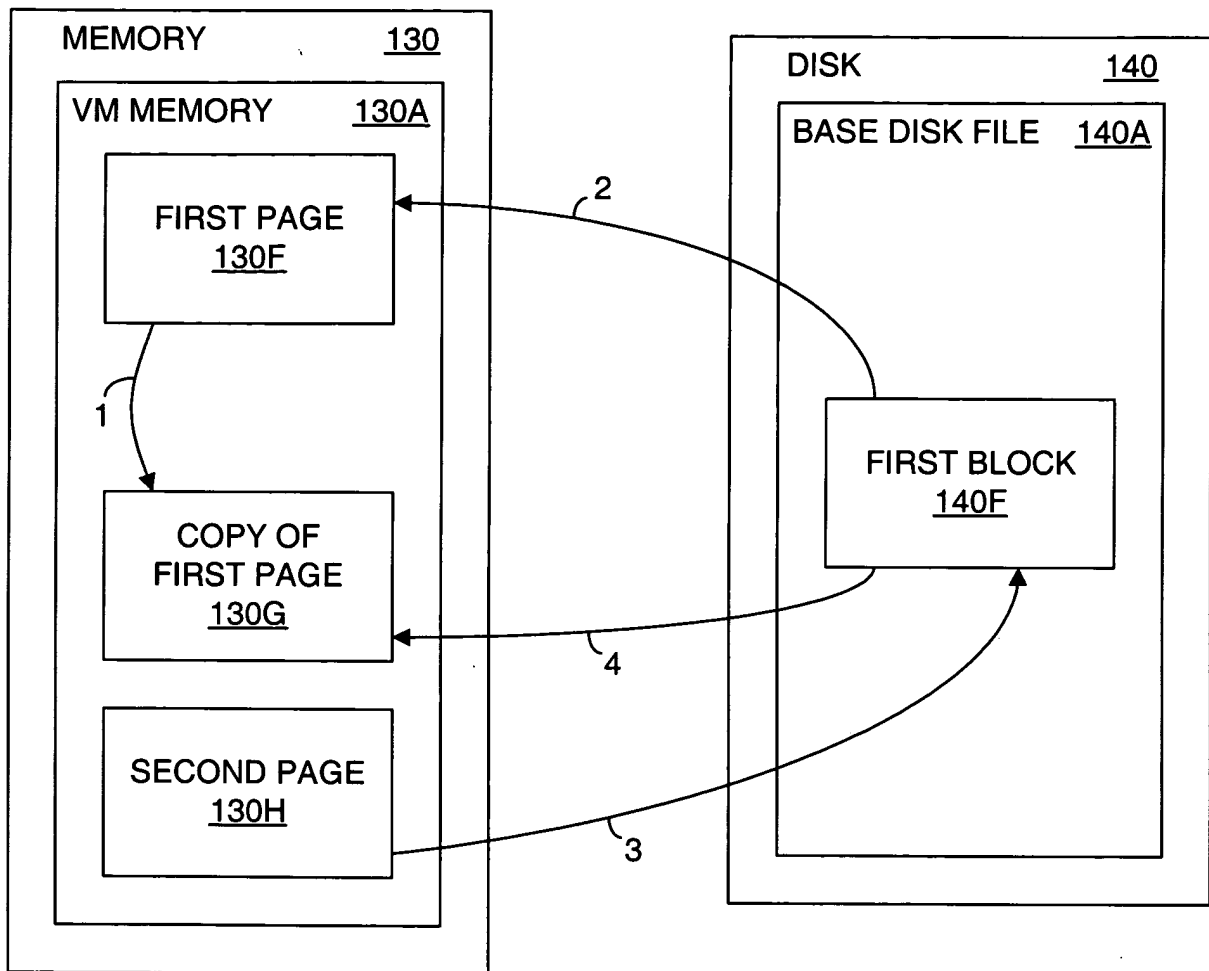


FIG. 3C



**FIG. 3D**

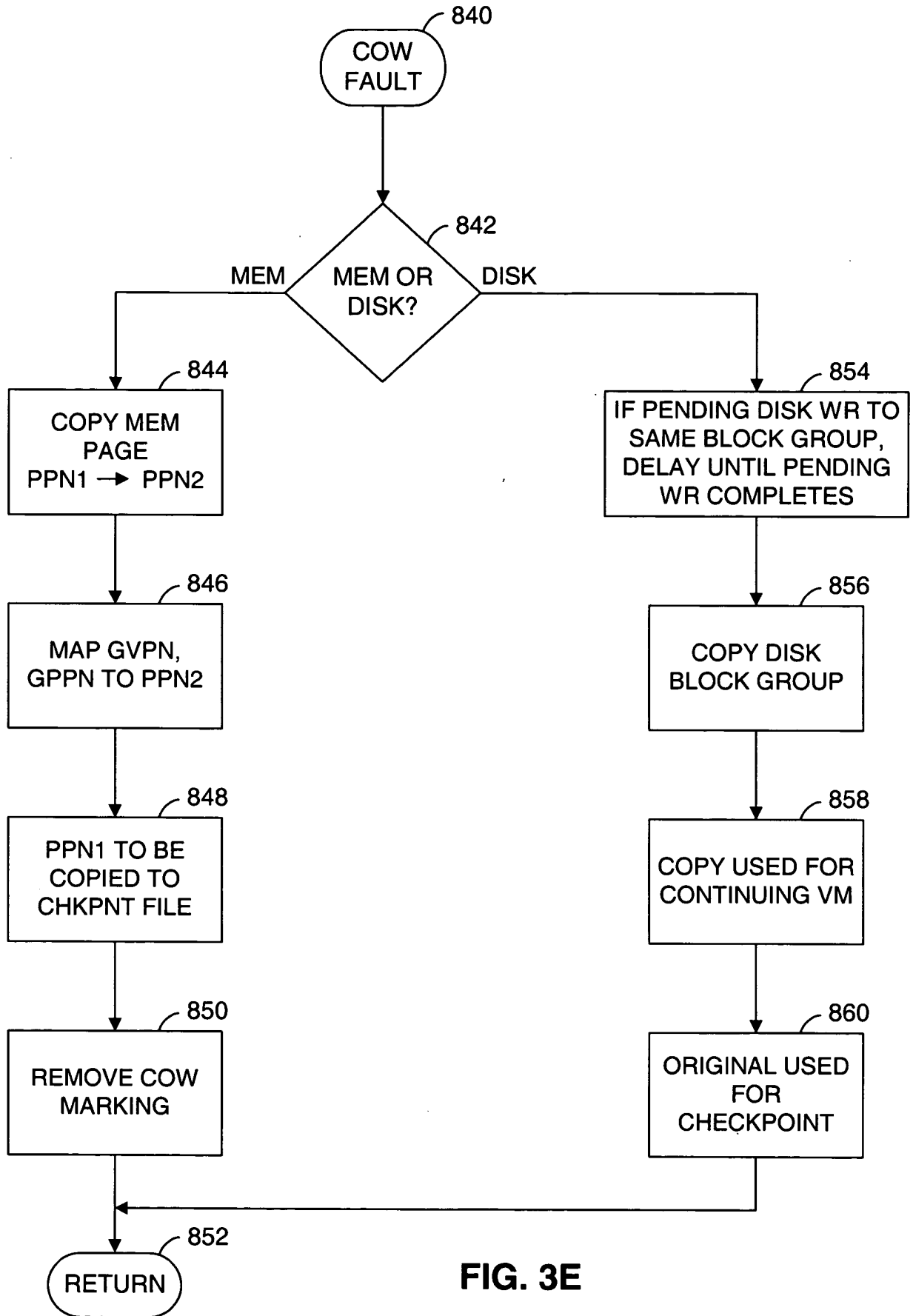
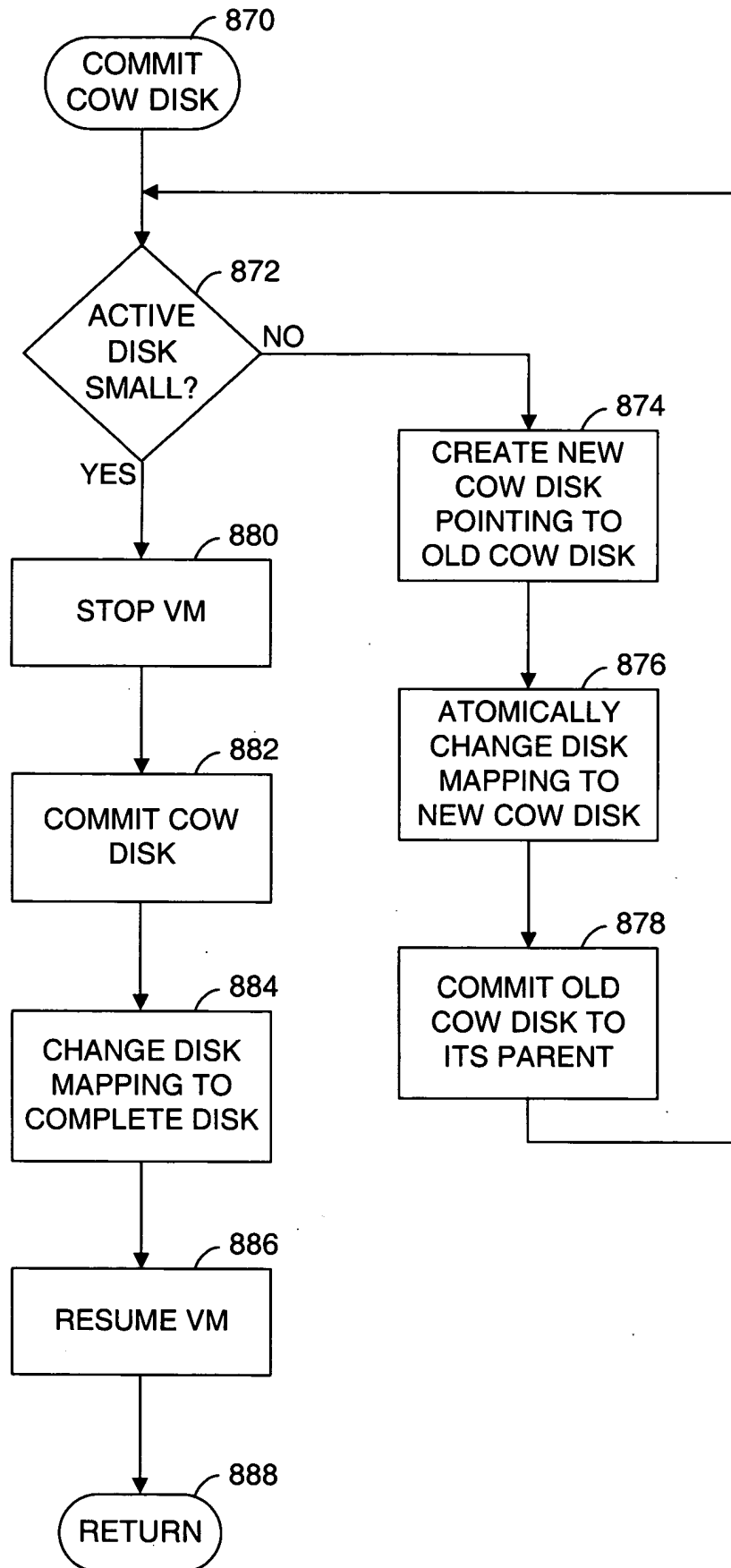
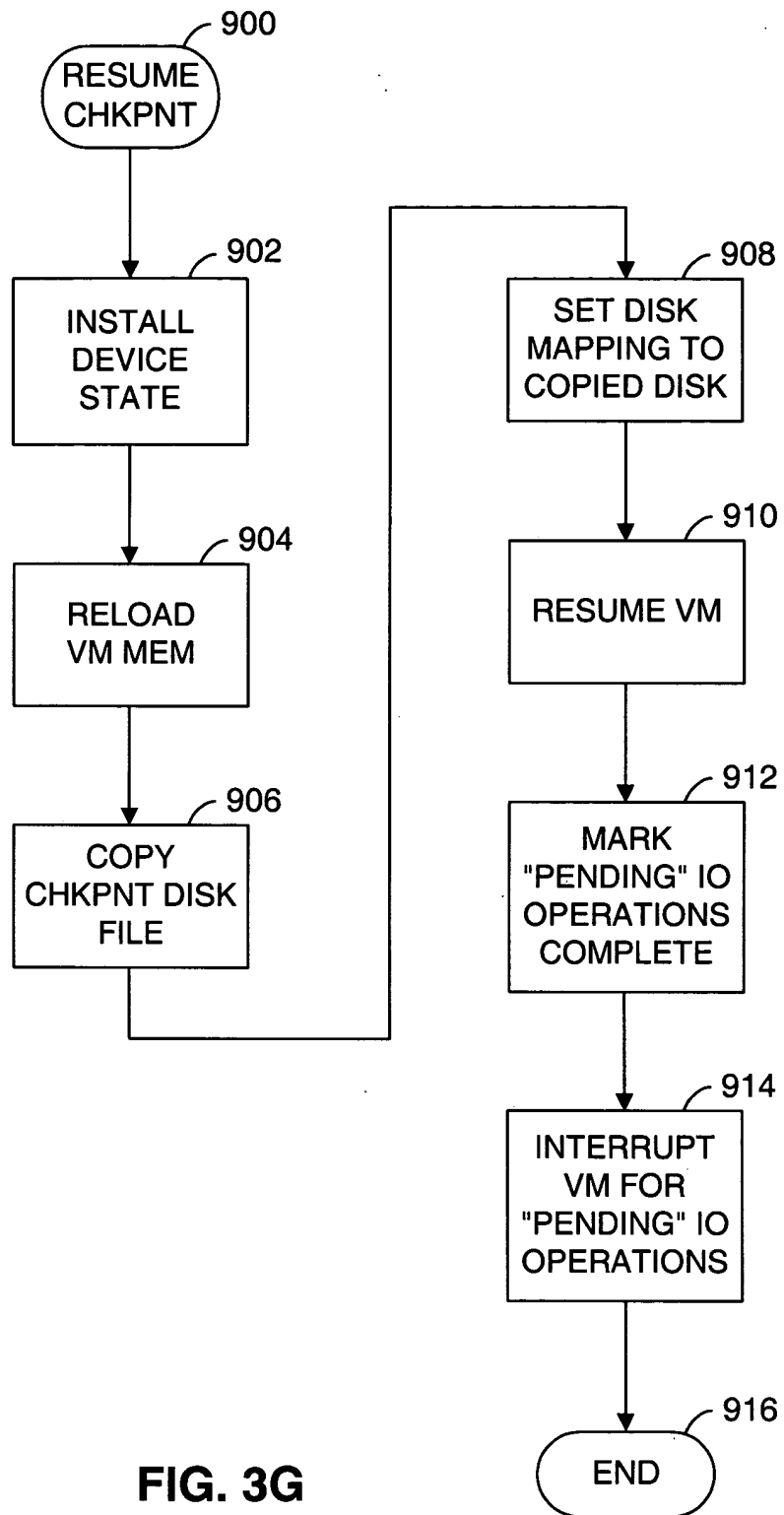


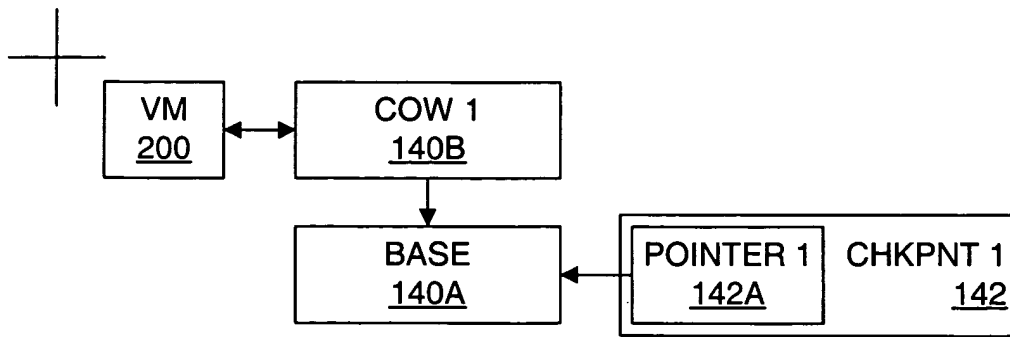
FIG. 3E

FIG. 3F

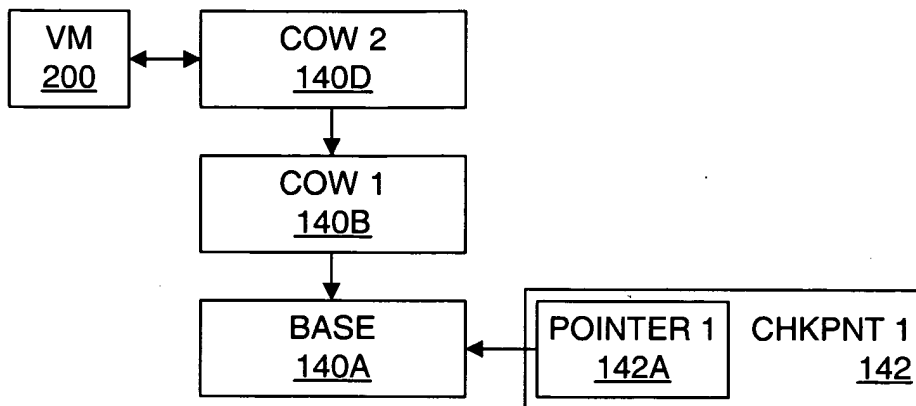




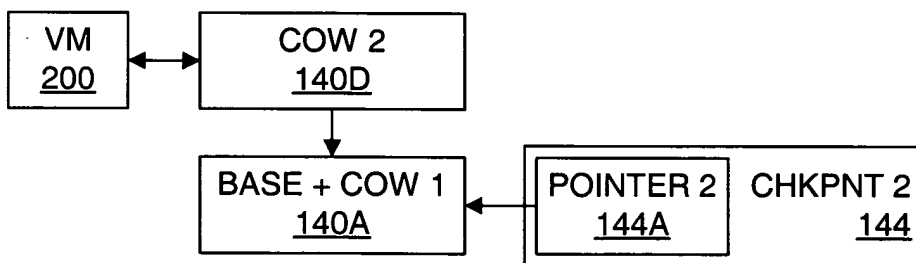
**FIG. 3G**



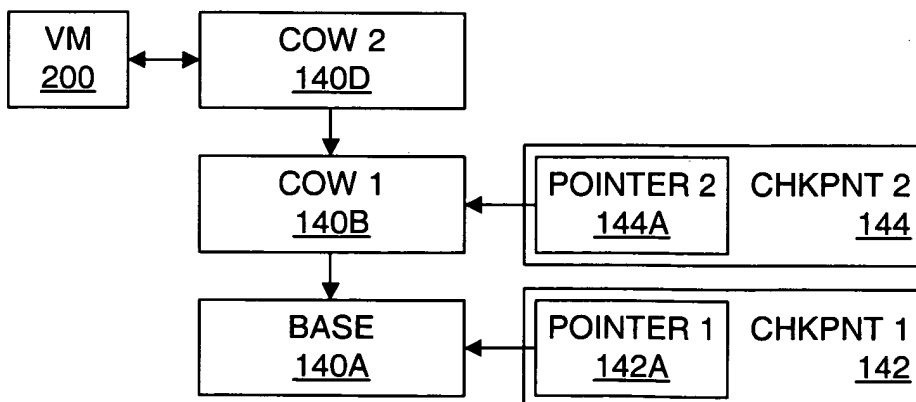
**FIG. 4A**



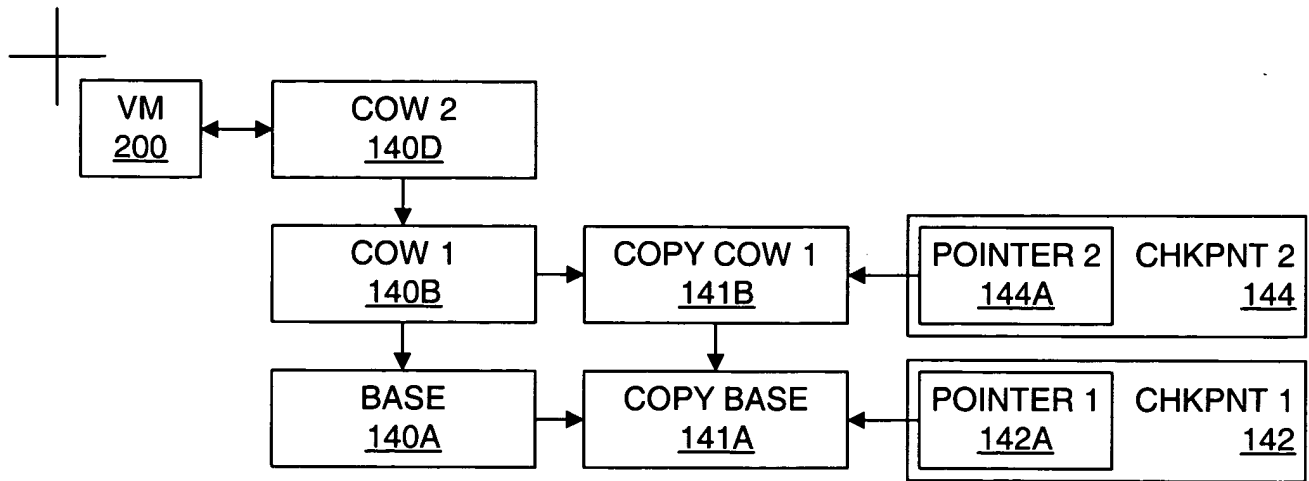
**FIG. 4B**



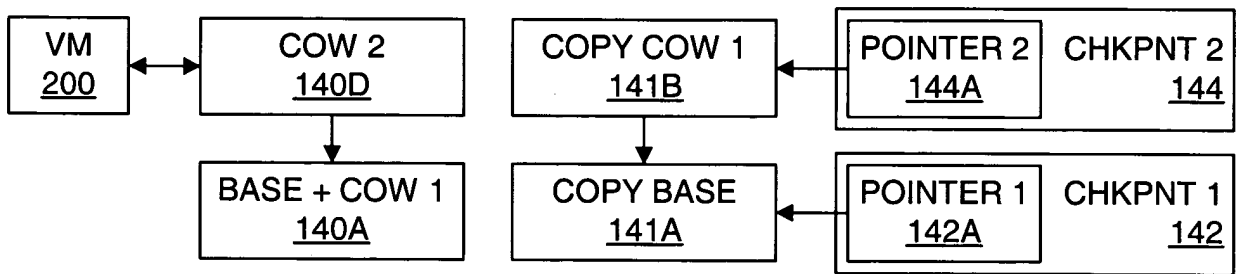
**FIG. 4C**



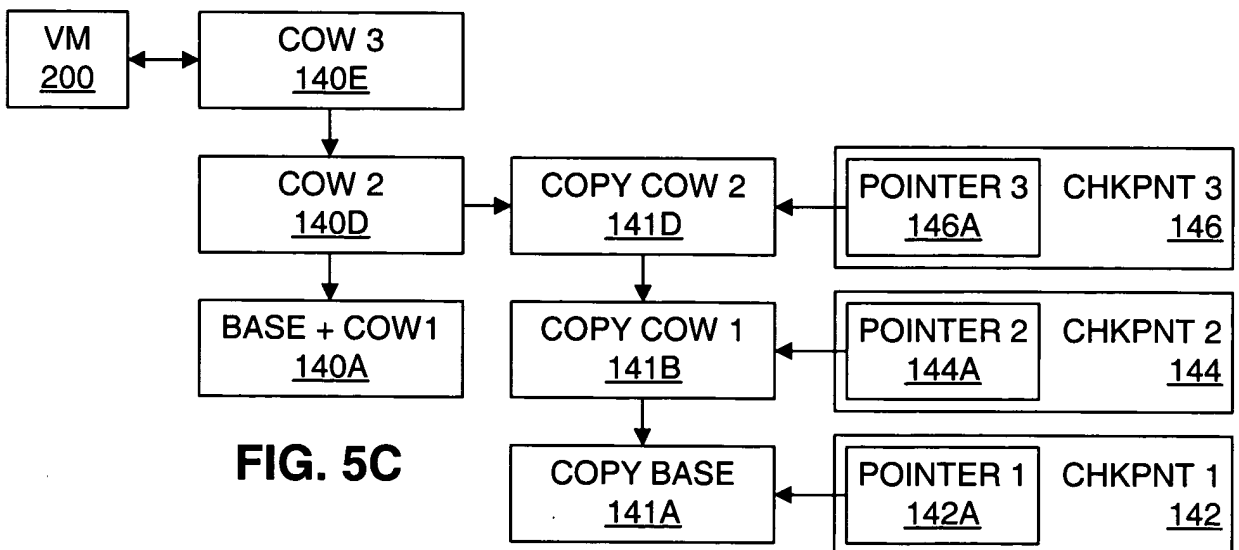
**FIG. 4D**



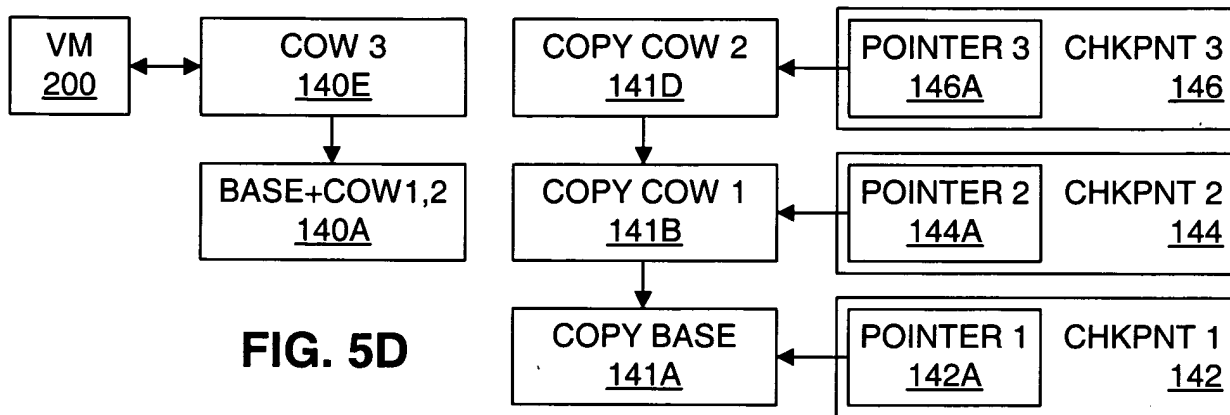
**FIG. 5A**



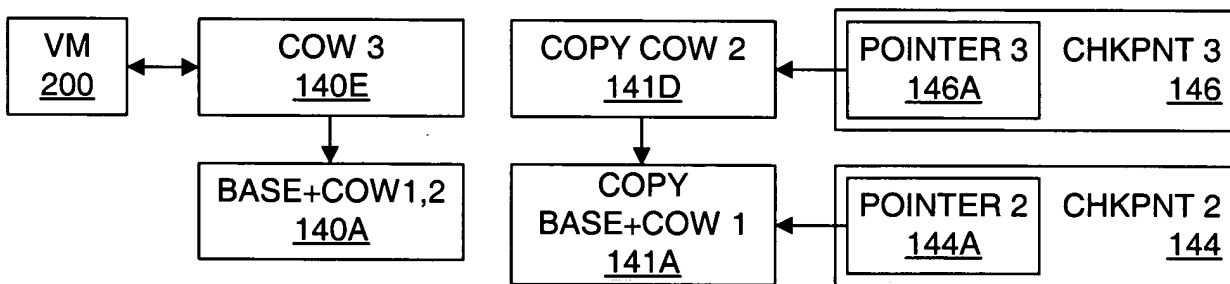
**FIG. 5B**



**FIG. 5C**



**FIG. 5D**



**FIG. 5E**